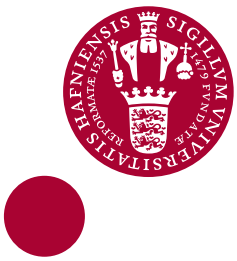

Smallholders' demand for and access to private sector extension services

A case study of contracted cotton producers in Northern Tanzania

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Abstract

This article examines demand for and access to private sector extension services by contracted cotton producers in Northern Tanzania. Data from a non-random survey of 520 smallholders shows that only 21.9% received any extension and only 4.6% received extension from the cotton ginnery. Wealthier households were three times more likely to receive extension from any provider. Whilst the public sector remains the main source of extension and is prioritised by smallholders, almost all households demanded extension from firms and are willing to invest 3 days per month mainly for advice on cotton and maize production. Involving third parties in the supply of extension from ginneries could not only meet smallholders' demands but could increase cotton supply, repayment rates to the firm and thus finance the provision of missing extension advice.

Keywords: *Private sector extension, cotton sector, Tanzania, Africa*

Agricultural extension services involve the creation and dissemination of knowledge and information to farmers, enabling them to clarify their own goals and educate themselves on how to make better decisions (Van den Ban & Hawkins, 1996). Whilst the public sector has traditionally played a central or sole role in providing agricultural extension services, recent years has seen a considerable shift towards pluralistic extension service systems with diverse means of funding, service provision and delivery (Birner *et al*, 2006; Davis, 2008; Friis-Hansen, 2004).[1] Originally, public extension took the form of a one-way linear transfer of knowledge from research to farmers. The Training and Visit (T&V) system aimed to strengthen top-down management systems, improve extension agent-farmer ratios and provide basic support services to the high number of field staff (Swanson & Rajalahti, 2010). Ultimately, this blueprint for national extension proved financially unsustainable (Anderson & Feder, 2004; Davis, 2008; Friis-Hansen, 2004; Swanson & Rajalahti, 2010). Reductions in public expenditure through the 1980s and early 1990s left many smallholders with a residual, modified and downgraded version of the T&V system (Friis-Hansen, 2004). At this time, and in contrast to conventional extension services, participatory Farmer Field School approaches offered a platform where stakeholders could share ideas and foster holistic and sustainable innovations (such as conservation agriculture and integrated pest management). In this respect, extension became increasingly demand driven (Friis-Hansen, 2004).

Private sector extension has also become part of this pluralistic approach and is common when traditional export crops are produced under a contract farming basis. Smallholders have an incentive to follow advice in order to access inputs and markets.[2] For their part, firms have

[1] Based on the argument that the term *extension* emphasises one-way transfer of knowledge, some scholars distinguish between agricultural extension services and agricultural advisory services (Swanson & Rajalahti 2010).

[2] Following Ellis (1994), we understand smallholders as farm households on customary land who are partially integrated into incomplete markets. They are in an uneven process of transition towards integrated market economies, are often subordinated to more powerful social groups, and are subject to internal differentiation.

an incentive to invest in extension in order to secure sufficient quantity and quality of produce (for recent reviews on contract farming see Barrett *et al*, 2012; Oya, 2012; Prowse, 2012; Da Silva and Rankin, 2013; Ton, Wellema *et al*, 2016). The degree of private sector extension is often determined by the nature of the crop in question, production system and labour demand (Poulton et al. 2010; Oya, 2012; Will, 2013).

Using original survey data, this article examines demand for and access to private sector extension services by contracted cotton producers in Northern Tanzania across three wealth groups. The article contributes to existing literatures on extension and contract farming in three ways. First, the article illustrates a simple technique for constructing wealth groups (through principal components analysis) which allows comparisons across social strata to be conducted with ease. Second, by using these techniques, the article confirms wealthier households were almost 3 times more likely to access agricultural extension (from any provider) than poor households (thus contributing to social stratification).

Third, and most importantly, the article highlights a tension within the limited delivery of extension services to smallholder communities. Only 21.9% of households received extension in the 2013/14 season. Despite their relationship with a ginnery, households received most extension from the public sector and prioritised this as their preferred provider of extension: only 4.6% of contracted cotton producers received extension from the firm.

Although the firm failed to deliver extension to almost all contracted growers, 98.7% of smallholders were willing to invest an average of 3 days per month participating in extension from the ginnery. In other words, considerable demand for extension from the ginnery was

Very large landowners on customary land tend not to participate in farmer business groups for contract farming but simply have direct contracts with the ginnery. For an explanation of farmer business groups see the section entitled The Cotton Sector in Tanzania.

not being supplied. We theorise this lack of supply as a classic contract enforcement issue and highlight how involving third parties within the supply of extension from the ginnery could not only meet smallholders' demands but also increase cotton supply and repayment rates to the firm.

The article is structured as follows. The next section introduces private sector extension services. The third section outlines the cotton sector in Tanzania. The fourth section outlines the firm the research was conducted with as well as the research and analytical methods. Section Five offers a concise description of the results. Section Six offers a discussion of the implications for theory and the policy implications from the findings. The seventh and final section concludes.

Private Sector Extension Services within Contracting Schemes

The literature on private sector extension services highlights five recurring issues within such schemes. First, the method and mode of delivery is dominated by technical top-down communication aiming to achieve increased productivity of specific crops and not the farming system as a whole (Poulton *et al*, 2010; Swanson & Rajalahti, 2010). Second, incompatible or conflicting interests between farmers and firms may occur in the areas of food security, environmental management and crop diversification (Van den Ban & Hawkins, 1996). Third, the outreach of private sector extension services are likely to be restricted to high potential areas with good infrastructure (for example, see Muyanga and Jayne, 2008). As Christoplos (2010) states, access to market-orientated agricultural extension services often ends at the end of the tarmac road. On this basis Rivera *et al* (2006) argue that effective extension systems requires core capacity in the public sector that promotes well-coordinated pluralistic extension

services. Hence public extension policy could facilitate the development of private sector extension and secure gradual withdrawal of the public sector where appropriate (Anderson & Feder, 2004; Rutatora & Mattee, 2001). Fourth, if private sector extension is poorly designed or conflicts with smallholders' interests, it undermines one of the key arguments for having such embedded extension activities (that it provides access to scarce resources for smallholders – Smalley, 2013). Smallholders certainly face severe barriers in taking advantage of opportunities provided by export and urban markets. Whilst extension through contract farming is not a panacea for breaking down these barriers, it is one of the few tools available to improve smallholders' capacity to participate (Christoplos, 2010).

During recent decades the Tanzanian extension system reflects some of these four generic issues. The National Agriculture and Livestock Extension Rehabilitation Project (NALERP) was launched in 1988 based on a government-initiated T&V structure. But the top down and supply-driven nature of the program proved inefficient and unsustainable (Rutatora & Mattee 2001). From 1997 the National Agricultural Extension Project Phase II (NAEP II) became operational but faced similar problems as the previous T&V system (Friis-Hansen 2004). The decentralisation of public extension services became a reality by the end of the 1990s with responsibility for disseminating agricultural extension services resting with local government authorities (Friis-Hansen 2004). Furthermore, Tanzania's Department for Research and Development decentralised leading to a reduction of public institutions working with research and crop development (Bargawi 2015). Overall, public involvement in extension, input provision and research activities, especially in the cotton sector, has declined creating increased room for the private sector (Bargawi 2015; Ponte 2002).

The fifth and final issue is the heterogeneity of smallholder participants (see Bargawi, 2015; Bellemare, 2012; Ellis & Mdoe, 2003; Larsen, 2006). During commercialisation, smallholders become increasingly stratified into classes and differentiation widens over time (Bernstein, 2010). For example, Jayne *et al* (2010) have documented large disparities in smallholder land distribution and household income per capita within Ethiopia, Kenya, Malawi, Mozambique, Rwanda and Zambia: households in the largest land quartile controlled between 5 and 15 times more land than the smallest quartile; the income of the top quartile was, overall, twice that of those in the bottom quartile.

Class dynamics and the stratification of smallholders are crucial to get a comprehensive understanding of access to extension services.[3] Two processes of differentiation are relevant to extension provision provided through contract farming: (i) first, differentiation between participants and non-participants; and (ii) second, differentiation among participants (Smalley, 2013). [4]

The considerable and growing differentiation between participating and non-participating smallholders through contract farming occurs because the speed of commercialisation increases as rural elites and the upper strata of smallholders are engaged and linked to larger, often global, markets. Poorer farmers, including women-headed households and farmers with smaller and less favourable plots, are often excluded. Elite capture and the lack of involvement by poor and marginalized smallholders in contract farming services stems from both farmers and firms. Farmers' own risk aversion and lower valuation of information provided therein can limit participation (Anderson & Feder 2004; Poulton et al. 2010; Smalley 2013). Firms' implicit and explicit preference towards wealthier farmers (see

[3] Access can be defined as the rules and social norms that determine the ability of smallholders in rural areas to own, control, claim, or make use of resources (Ellis 2000).
[4] Intra-household dynamics are outside the scope of this article (see Prowse 2012; Smalley 2013).

Bargawi 2014; Bellemare 2012; Poulton et al 2010; Swanson & Rajalahti 2010) is based on their requirement for high quality produce, bulk production and prompt performance (Christoplos 2010). This process can increase community-level inequality, thin spot markets, but also changing labour market dynamics for poorer households (see Singh 2002; Oya, 2012; Singh & Prowse 2013; Smalley 2013). Differentiation within smallholder participants in contract farming schemes stem from similar reasons as those described above and is exacerbated by firms operating different grades of contracts (see Moyer-Lee and Prowse, 2015; Larsen, 2006). This article adds to the current literatures on extension and contract farming by assessing the extent to which demand for and access to extension differs across wealth groups (created using principal components analysis) within a contract farming scheme. We now turn to an overview of the cotton sector in Tanzania.

The Cotton Sector in Tanzania

After independence and *ujamaa*, ginneries previously owned by Asian businessmen passed into the hands of rural cooperatives and a statutory cooperative system was created: Primary Cooperative Societies (PCSs) handled marketing of seed cotton, while Regional Cooperative Unions (RCUs) did the ginning. RCUs sold a proportion of seeds to PCSs for distribution to farmers and sold the cotton lint to the Cotton Board. Both the PSCs and RCUs had monopsonies, while the Cotton Board had a national monopoly on lint exports and a monopsony on importation of pesticides (distributed on credit to RCUs). Furthermore, the Cotton Board set pan-territorial and pan-seasonal producer prices.

During the 1970s poor management, overstaffing and poor credit recoveries led to liquidity crises for the Cotton Board which was often unable to purchase crops from RCUs on time (Tschirley *et al*, 2006). The debts of the Cotton Board and RCUs increased rapidly. Structural reforms were implemented in a piecemeal fashion until the Cooperative Act in 1991 and Cotton Act in 1994 allowed competition at all levels of the cotton system. From the 1990/91 agricultural season RCUs had greater pricing autonomy on seed cotton purchases. The 1991 Act also privatised RCUs and PCSs at the same time as allowing easier formation of new cooperatives. RCU debt was written off several times between 1991- 1995 and donors started to finance a program of ginnery rehabilitation with low interest loans leading a fast transition to a competitive market with numerous buyers and ginners competing for farmers' produce (Tschirley et al. 2006). The 2001 Cotton Industry Act facilitated the formation of the Tanzanian Cotton Board (TCB) that came into operation in 2004. The TCB has since been responsible for promoting, facilitating and monitoring the production, marketing, processing and export of cotton.

One recurrent and continuing issue has been the lack of access to inputs. This was initially addressed through the Agricultural Input Trust Fund and later by the Cotton Development Fund (CDF) established in the late 1990s and which put a levy on cotton exports (with part of the revenue funding chemical imports and distribution to local governments at a discounted price). The CDF had a degree of success but the fund crowded out private dealers. It also suffered from corruption and sudden policy shifts (such as a shift from oil-based to water-based chemicals, which farmers did not have the necessary knowledge and equipment to apply - Tschirley et al. 2006). During the 2000s, several new interventions were taken by the TCB to provide some minimal level of inputs to farmers based on levies paid by the private sector and coordinated by the CDF (later renamed the Cotton Development Trust Fund,

CDTF). A Passbook System was implemented in 2002/03. Through the Passbook System each producer, based on the quantity of produce sold, was entitled to receive a quantity of chemical inputs allowing one spraying in the following season. Inputs were financed through a cotton levy per kg of seed cotton paid by both farmers and ginners. Thus, the system can be seen as a form of forced savings for inputs, distributed the subsequent season. But the system faced severe challenges. For example, Bargawi (2015) highlights ginners noting false amounts in producers' passbooks and how the system only allows inputs for smallholders who produced cotton the previous year. The Passbook System lasted until 2008 and was replaced by the so-called voucher input system: smallholders received vouchers and supply of inputs was left in the hands of private agro-chemical dealers. The voucher input system was also afflicted by severe problems and subsequently abandoned. Low yields and deteriorating cotton quality remain significant challenges for the sector (Mwinuka and Maro, 2013; Lorenzetti, 2014).

The latest attempt to secure input provision and access to extension services for smallholders in the Tanzanian cotton sector is through contract farming arrangements financially supported by the UK-based Tanzanian Gatsby Trust (TGT) and coordinated by TechnoServe on behalf of TCB. The contract farming scheme was piloted in Mara region between 2008 and 2011 where five ginneries were licensed and involved in contract farming arrangements with smallholders. In order to gain access to inputs on credit and extension services, smallholders were required to form farmer business groups (FBGs). During the pilot phase, the formation and training of FBGs (democratic election procedures, accounting records and contract contents) were led by TechnoServe. Ginners provide producers with inputs and services that

are repaid out of cotton output (Bargawi 2015).[5] The contract farming system was subsequently 'rolled-out' to the entire Western Cotton Growing Area in 2012, covering more than 50 competing ginneries and 350,000 smallholders (Nsimbila, 2015). This study focuses on the extent smallholders contracted by one ginnery have equal access to and demand for extension services. We now describe the research methods conducted as well as the analytical approach.

Research Methods and Analytical Approach

Primary research was conducted in late 2014 in Bunda District, Mara Region, the fourth largest cotton-producing area in Tanzania with an estimated 21,151 households growing 18,634 hectares of cotton (URT 2012a). The research was conducted with S&C Ginning. S&C procures unprocessed seed cotton and gins it into bales. In the 2012/2013 season the firm procured 17,642 tons of seed cotton pressed into 30,300 bales (TCB 2013). In addition to cotton lint, the company's oil mill produces edible oils for the local market. Husk, cake and soap are also sold. The firm operates an intermediary model of contract farming where direct contact with FBGs is delegated to inspectors and field agents. This model has contributed to repayment rates that have not exceeded 45 – 50 percent at any given point, significantly lower than repayment rates experienced for cotton in other African countries (Tschirley *et al*. 2010). The firm currently does not employ any extension staff but instead inspectors are trained to become conversant in good agricultural practices and disseminate advice. In sum, contact between the company and farmers operates through inspectors, the chairman, the secretary

[5] In their 2013 annual report the TGT reports that 15 ginners has made contract arrangements with nearly 93.000 farmers, covering about 50.000 acres in the 2013/14 season. Ginners extended loans on seeds and pesticides, while also coordinating delivery of extension services as part of the arrangements (TGT 2013).

and in some cases also agents.[6] Operations are characterised by poor vertical coordination and low interaction between farmers and firms, limiting oversight of smallholders' production process. Hence, the company is struggling to secure returns on investments through CF arrangements.

Our findings are mainly based on a household survey of 520 household heads from eight Farmer Business Groups conducted with 10 enumerators recruited from Mzumbe University. The eight FBGs were between 3 and 24 kilometres away from the ginnery. The sample size and distance were determined by the resources available for the study. Our purposive sample is not representative of a broader survey population. Moreover, the extent to which these findings could be extrapolated to a representative sample is limited. It is well known that contract farming arrangements engage with the upper strata of rural communities and exclude the poorest households (for example, see Singh and Prowse, 2013). As all survey participants in this survey were engaged in contract farming with S&C Ginning, it is highly likely the survey did not reach poor and marginalised groups. ~~Dates and central locations for interviews were decided in collaboration with the chairman and secretary of the FBG to ensure that members would be available to participate and to minimise costs.~~ The team sought to interview all members of FBGs. If a household did not arrive, the team would, if possible, visit their homestead to see if they were available later that day. Respondents were offered a soft drink as a token of appreciation for participating in the survey. The questionnaire was drafted in English, translated in plenary into Kiswahili and conducted either in Kiswahili or the vernacular. Answers to open and closed questions were recorded in English. Dates and central locations for interviews were decided in collaboration with the chairman and secretary of the FBG to ensure that members would be available to participate and to minimise costs.

[6] Inspectors and agents are S&C staff that facilitate the company's side of the contract. Each FBG has a chairman and a secretary taking care of their side of the operation. The chairman and the secretary are also cotton farmers.

Around 11 percent of respondents were women. The findings also rely on semi-structured interviews with the General Manager of S&C Ginning Company Limited (S&C) and Program Coordinator of the Tanzanian Cotton and Textile Development Programme at Tanzanian Gatsby Trust (TGT).

The analysis of quantitative data is conducted through using principal component analysis (PCA) to stratify contracted smallholders into wealth groups, followed by descriptive statistics using both parametric and non-parametric tests.

PCA reduces a numbers of continuous variables from household surveys into a single index through extracting underlying components (Dossa 2011; Vyas & Kumaranayake 2006). We use PCA to create an asset index to stratify contracted HHs into different wealth groups. First, we select variables representing natural, physical, human and financial capitals from the well-known livelihoods framework (see Ellis, 2000).

< Table 1 around here >

Secondly, variables were cleaned and checked for missing values or incorrect outliers. In correspondence with other studies using PCA, missing values are in this study replaced with mean values for the variable (Gwatkin et al. 2000; Vyas & Kumaranayake 2006). The occurrence of outliers and percentage of missing values was small less than 1 percent (except for construction materials).

The third step was to test if the chosen variables are suitable for PCA. Correlation coefficients show significance above 95 percent for all variables. In addition, Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity are applied to determine the adequacy and significance of variables. The result of Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0,714, well within the necessary range for PCA (0,5 – 1,0) while Bartlett's test of Sphericity was significant (0,000). In sum the three tests underlines that the selected variables are apt for PCA.

Fourth, by rejecting all components with an eigenvalue less than one, PCA creates one or more components explaining variance between HHs. In this case, PCA created one component with an eigenvalue of 2,184 that was able to explain 43.7% of the variance in the original variables. As our observations in the field suggested an organic Leninist process where members of the rural elite were emerging from free family farms, we follow Filmer and Pritchett (2001) and Vyas and Kumaranayake (2006) who both use a 40/40/20 split. Indeed, Vyas and Kumaranayake (2006, p. 464) state that "commonly used arbitrary cut-off points are classification of the lowest 40% of households into 'poor', the highest 20% as 'rich' and the rest as the 'middle' group". To reflect our observations in the field and capture the concentration of assets among better-off contracted smallholders, we chose to stratify HHs into three wealth groups based on these arbitrary cut-off points. The terms poor, middle and rich contracted households must be understood as relative terms based on a combination of the HHs asset endowment. In summary, the approach we used combined both a theory-driven and data-driven approach to the grouping of households.

Based on this stratification, our analysis used Chi-squared tests, Cramer's V, Fisker's Exact Test, Kruskal-Wallis H test and One-way ANOVAs depending on the nature of the variables.

Table 2 offers an overview of significant differences in asset ownership across the 3 wealth groups. Overall, principal components analysis is a relatively new and innovative approach to constructing wealth groups. We now turn to the findings from our survey of 520 households.

<Table 2 around here>

Findings

Despite the fact that all of the 520 surveyed households were a member of a FBG and were contracted to grow cotton by the ginnery, Table 3 illustrates that only 21.9 percent of smallholders accessed any extension services in the 2013/14 agricultural season. Looking across wealth groups we find a strongly significant difference: 35.6 percent of rich ~~households~~, 24% of middle ~~smallholders~~ and 13% of poor contracted smallholders had access to extension. In other words, every third rich smallholder had access to extension while only one in eight poor households had access to extension (Chi-squared test χ^2 = 21,588; df = 2; α 0,000; Cramer's V test φc = 0,204).

The findings show that contracted cotton producers that accessed extension services (from any source) received information on cotton (74,1 - 86,5 %) and maize (59,3 – 67,6 %) mainly, as well as on cassava, beans, sunflowers, groundnuts, forestry, chickpeas and sesame (7,4 – 10%). In addition a proportion of rich farmers accessed information on millet (21,6 %). Millet

is the only crop where the differences between wealth groups is significant (Fisher Exact Test = 6,1666, α = 0,036).[7]

Table 4 shows that there is no clear pattern between distance to the ginnery and access to extension. Smallholders' access to extension varied between 9,3 percent and 30,2 percent in different FBGs. In fact, farmers in Neruma experienced the best access to extension and are located the furthest away from the ginnery.

Of the 114 smallholders that received extension, services were accessed from the public sector (60 – 74,1 %), followed by the private sector (16 – 25,9 %), farmer based organisations (11,1 – 24 %) and lastly NGOs (3,7 – 18,9 %). None of these differences between wealth groups are statistically significant. Of the full sample of 520 HHs, the public sector only reached 14.6 percent, the private sector 4,6 percent, FBOs 4 percent and NGOs 2.3 percent. These figures highlight poor involvement of all potential extension providers.

Turning to the mode of delivery of extension, most of the 114 smallholders who received some extension did so through group meetings (48.1 – 66,7 %), farm visits (51,9 – 58,3 %) followed by the lead farmer demonstrations (14,8 – 27,8 %). There were no significant differences across these wealth groups. A variety of other sources including radio, cell phone, posters and pamphlets were also reported (8 – 18,5 %). Overall, a low degree of pluralism exists when it comes to sources of information with most farmers relying on group meetings and farm visits.

[7] The Fishers Exact Test is an alternative to Chi-squared test for nominal variables when responses of wealth groups are polarised and concentrated.

The content and the helpfulness of crop-specific extension in different areas of the crop cycle was assessed. Of the 114 contracted households receiving extension, most received advice on planting (91,8 – 96,3 %), pest management (88,9 – 91,2 %), land preparation (85,2 – 89,8 %), post harvest storage (77,6 – 85,2 %), soil fertility (78,4 – 85,2 %), crop rotation (61,2 – 73 %) and water management (49 – 63 %). More than 96 percent of responses found all these different forms of extension as helpful or very helpful. This corresponds with the annual survey of the Cotton and Textile Development Programme (CTDP 2014) where 84 percent of all smallholders found extension from ginners either helpful or very helpful. We now turn to smallholders' demands and preferences regarding extension in the future regarding providers, mode of delivery, crops and content of extension.

Smallholders across all three wealth groups prioritise the public sector as the main provider of extension services (40,9 – 43,3 %), followed by FBOs (19,2 – 23,1 %), ginners (12,5 – 17,3 %), other private companies (7,7 – 8,7 %) and NGOs (6,7 – 10,6 %). There were no significant differences across wealth groups. Importantly, the vast majority of contracted smallholders (97,1 – 99,5 %) were willing to participate in private sector extension. Smallholders reported they were willing to spend an average of 3 days per month at extension meetings offered by S&C. Smallholders' preferences were for group meetings and farm visits for cotton and maize.

Overall, our findings show that only one fifth of contracted smallholders received extension and that the wealthiest smallholders were almost 3 times more likely to do so than the poorest households contracted by the ginnery. On the other hand, the assessment of smallholders' demand, preferences for and valuation of extension tells a statistically uniform story across all wealth groups:- Contracted ~~S~~smallholders prefer pluralistic provision of extension based on a

strong foundation of public sector services, with involvement of all potential extension providers. The preferred mode of delivery and crop preferences correspond with the modes used and crops targeted in the existing system.

When it comes to private sector extension, the findings show a contradiction. Despite their relationship with a ginnery, only 4.6% of contracted cotton producers received extension from the firm. But despite the firm failing to deliver extension to contracted growers, 98.7% of smallholders were willing to invest an average of 3 days per month participating in extension from the ginnery. We focus on this tension in the discussion, to which we turn now.

Discussion

Our finding that only 21.9 percent of smallholder had access to extension conflicts with a recent survey conducted by the National Bureau of Statistics of the United Republic of Tanzania (2012b) in the 2007/08 agricultural season. This survey reported that 68 percent of all HHs in Mara Region had access to extension services and 66.1 percent of HHs in Bunda District had access.[8] However, a number of academic studies conducted throughout the last decades document a similar poor level of public extension in Tanzania (Bargawi 2015; Tschirley et al. 2006; Poulton et al 2004; Rutatora & Mattee 2001). In short, government extension services at district and village level can be viewed as weak. This is underlined by CTDP (2014) who argue that extension officers lack knowledge and demand extra payments

[8] The differences between the two studies are potentially impacted by three factors either: (i) a significantly higher extension effort was present in the 2007/08 season; (ii) the present study being conducted far from urban centres in a pocket of low access to extension or (iii) access is overestimated by the National Bureau of Statistics or underestimated by smallholders interviewed in the present research.

to attend trainings to disseminate information to farmers (indeed, five respondents reported that in our survey).

Moreover, the current intermediary model of CF implemented by the firm is failing to provide smallholders with sufficient agricultural extension services. This chimes with a recent finding from CTDP (2014) from a statistically representative survey of all cotton producers in the Lake Zone which highlighted that only five percent of smallholders under CF arrangements received private sector extension services from a ginner in 2013/14 (CTDP 2014). The study also reveals that only a fraction of ginners are investing in extension services.

When we compare our findings to the typology of African cotton sectors compiled by Tschirley et al (2010), Table 5 shows how Tanzania displays the expected characteristics of a competitive cotton sector: low input provision; low degree of extension provision; and low yields. One possible solution to this is greater horizontal coordination which can strengthen alliances of stakeholders at various levels of the value chain. Coordination amongst ginners has the ability to heighten the joint level of investment in extension and limit the risk of default. This has already happened in Tanzania with a coalition of ginners binding themselves together. Stronger coordination amongst smallholders within authentic farmer organisations also has the potential to improve their attractiveness as business partners and secure their access to extension.

<Table 5 around here>

The tension within the findings on private sector extension (that all smallholders want to participate in a great deal of it, but that it is not being supplied by the ginnery) are

counterintuitive but do also highlight an opportunity for greater coordination between stakeholders. To understand why this is the case, we need to reflect on transaction cost approaches to understanding markets.

Williamson (1979) highlights how markets consist of actors with bounded rationality (that they suffer from severe information deficiencies, and are unable to process all the information available to them) and who are opportunistic (in essence, that actors often deceive, lie, cheat and steal). Market transactions can thus entail considerable losses. We can understand the counterintuitive finding that the ginnery doesn't buttress the distribution of cotton seed and pesticides with dedicated extension services to smallholders through this lens. Qualitative data from the General Manager in the ginnery highlighted how the ginnery had encountered problems when hiring extension workers in the local job market:

> *In the years between 2008 and 2012 a number of extension workers were regularly heading out. Everyday we used to give them transportation and they used to go out. Our extension workers. To carry out these tasks. That was their primary task, whatever we were giving it on credit or not, extension was their primary task. But I do not know at this point of time how successful they were, and if they were really doing it. That's anybody's guess. We used to get reports that they met so and so, we have done so many, all the reports are there, but how successful there were we don't know. If any Good Agricultural Practices had really been implemented then…..the productivity would have gone up. But we have not seen any significant increase in the productivity.*

In essence, the ginnery was unable to monitor extension workers effectively in the field who appear to have engaged in opportunistic behaviour. Rather than throw good money after bad, the ginnery continued to provide seed and pesticides to FBGs but curtailed the provision of extension agents. This could be an area where stakeholders such as the Tanzania Gatsby Trust can facilitate the inclusion of third party providers of cotton-specific extension advice to FBGs the cost for which could be recouped from any productivity increases achieved from

those FBGs. Such as system is likely to work because involving third parties within contract farming schemes tends to increase the self-enforcement range of contracts due to the greater likelihood for reputation losses (see Gow *et al*, 2000), leading to higher repayment rates and margins for firms. As long as an incentive to achieve greater productivity is included in the terms of reference for third-party providers, and independent verification of this is stipulated, there are few reasons to believe such a system would not bring benefits for all actors.

Overall, our findings from contracted cotton growers support the argument that that rich smallholders in general benefit from better access to extension advice than poor smallholders in developing countries (see for example: Christoplos 2010; Haug 1999; Rivera 2011; Swanson & Rajalahti 2010). Furthermore, it underlines internal differentiation between accesses to extension for smallholders enrolled in CF arrangements (see Christoplos 2010; Friis-Hansen 2004; Haug 1999; Rivera 2011; Swanson & Rajalahti 2010). Based on this, we can also assume a greater degree of differentiation with many non-contracted smallholders (Smalley 2013). When looking at the demand for extension services, it can be argued that extension in itself is a prerequisite to enable smallholders to clarify and express their own goals and preferences (Christoplos 2010; Van den Ban & Hawkins 1996). The lack of insight to imagine alternative approaches potentially explain the broad uniform demand for a familiar extension system from our respondents.

Most importantly, we explain a contradiction regarding huge demand for and very limited supply of private sector extension as a classic contract enforcement issue. Involving third parties within the supply of extension from the ginnery could not only meet smallholders' demands but could increase cotton supply, repayment rates to the firm and thus finance the provision of the missing extension advice.

Conclusion

It is hard to argue against the viewpoint that the current extension system for contracted cotton growers is not fit for purpose: smallholders are not supplementing their current knowledge base with new information and current best practice. Current low levels of productivity are not a surprise. Moreover, wealthier households dominate the limited amount of extension offered exacerbating smallholder differentiation.

The findings offer one ray of light: that smallholders are willing to spend 3 days per month participating in agricultural extension from firms. Greater horizontal coordination among ginners and long-term producer organisations for smallholders are two avenues through which more and better extension can be offered by firms to all smallholders. Better coordination between ginners will allow these firms to reduce opportunistic behaviour and offer greater extension services to smallholders (as they have a greater likelihood of reaping the returns). At the same time, stronger horizontal coordination between farmers in the form of producer organisations will improve the ability to voice their extension needs and mobilise smallholders to raise their concerns to firms (see Poulton et al. 2010; Christoplos 2010). Our specific suggestion here is that third parties could deliver extension advice to farmers which could increase cotton supply, repayment rates to the firm and thus finance itself. Overall, though, and as illustrated by smallholders' own preferences, a pluralistic extension system will only thrive on the foundations of meaningful cooperation with a functional and up-to-date public extension system.

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Table 1 – Variables used in PCA

	Description of variable used for PCA
Natural Capital	Is represented by the aggregated acres of land owned and rented by the HH, together with the total amount of livestock owned represented by the Tropical Livestock Unit (TLU) of the HH.[9]
Physical Capital	Is represented by score of construction materials of house.[10]
Human Capital	Is represented by total Adult Equivalent Score (AES) of the HH.[11]
Financial Capital	Is represented by total household expenditure of the HH from October 2013 to September 2014 covering consumer expenditures, productive expenditures and total savings accumulated in the given period of time.

Source: Authors based on Ellis (2000)

[9] Both variables represent natural assets in the present study. They can also be characterised as financial capital, since ownership represents a monetary value and especially cattle ownership is a common way to accumulate savings in the study area. Furthermore cattle can be characterised as physical capital, due to its importance as draught power in farming activities amongst smallholders

[10] Based on an ordinal variable of construction materials used for floors, external walls and roofing a combined and continuous score for combined HH construction is developed. The higher the aggregate score, the better materials used to construct the house. Following numerical weights are used:
Floor: 4. Bare earth, 8. Mud/clay, 12. Wood, 16. Tile, 20. Cement, 24. Concrete.
External walls: 4. Mud, 8. Pole/bamboo, 12. Wood, 16. Mud bricks, 20. Burnt bricks, 24. Concrete blocks
Roofing: 4. Thatch, 8. Plastic sheets, 12. Tins or metals other than corrugated iron sheets, 16. Corrugated iron sheets, 20. Tiles.

[11] Adult equivalent is representing the family labour available for the HH. Only members that have been resident in the HH for more than 6 months and eat regularly in the HH are included.

Table 2 – Asset ownership by wealth group

Wealth group		**Access to assets by wealth group (mean values and standard deviation)**									
		Land holding (hectares)		**Livestock (TLU)**		**Construction material (score)**		**Family labour (AE)**		**Expenditures (Tsh)**	
	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Poor	208	2,4	1,1	2,1	4,9	32,7	10,9	4,4	1,7	1.888.960	994.457
Middle	208	4,7	2,8	7,3	8,2	40,6	11,5	6,8	2,0	3.302.264	1.556.797
Rich	104	11,6	7,3	28,1	27,6	45,2	11,6	9,1	3,5	5.705.733	3.185.163
Overall	520	5,1	5,1	9,4	16,8	38,4	12,3	6,3	2,9	3.217.636	2.307.680
		dfs = 2, 517 F ratio = 209,2 P = 0,00		dfs=2, 517 F ratio = 128,5 P = 0,00		dfs = 2, 517 F ratio = 49,2 P = 0,00		dfs = 2, 517 F ratio = 156,8 P = 0,00		dfs = 2, 517 F ratio = 149,4 p = 0,00	

Source: Household survey

Table 3 – Access to extension by wealth group

Wealth group		Access to extension (%)		
	N	Yes	No	Total
Poor	208	13	87	100
Middle	208	24	76	100
Rich	104	35,6	64,4	100
Overall	520	21,9	78,1	100
		$\chi^2 = 21{,}588$, df = 2, $\alpha = 0{,}000$, $\varphi c = 0{,}204$		

Source: Household survey

Table 4 – Access to extension by distance

FBG	N	Distance to S&C (Km)	Access to extension distributed by village (%)		
			Yes	No	Total
Buzimbwe	95	3	21,1	78,9	100
Guta	95	15	28,4	71,6	100
Kabainja	52	9	13,5	86,5	100
Karukekere	67	16	23,9	76,1	100
Kasuguti	51	8	17,6	82,4	100
Mwiseni	43	6	9,3	90,7	100
Neruma	53	24	30,2	69,8	100
Ragata	64	16	23,4	76,6	100
Overall	520	12	21,9	78,1	100
			$\chi^2 = 11,458$, df = 7, $\alpha = 0,120$		

Source: Household survey

Table 5 - Key indicators and expected performance by sector type

Type of indicator	Measured by	Expected performance		
		National and Local monopolies	Concentrated	Competitive
Process indicators				
Quality and marketing	Estimated average realised premium over Index A on world markets (US$/lb lint)	Medium – depend on management, culture and regulatory efficiency	High	Low
Pricing	Mean % of FOT price paid to farmers	Low if left to companies alone	Low	High
Input provision	a) % of cotton farmers receiving input credit b) Adequate/quality of input credit package, if provided c) Repayment rate	High	Medium	Low
Extension	a) % of companies providing assistance b) Qualitative assessment	High	Medium	Low
Research	No. of varieties released and taken up, past 10 years	High	Medium	Low
Intermediate outcome indicators				
Yield	Kg of seed cotton produced per ha.	High	Medium	Low
Company cost efficiency	Adjusted farm gate to FOT cost (US$/kg lint)	Low	Medium	High

Source: Tschirley et al (2010)

Reply to Referee Report on Manuscript ID JOAC-05-16-0091.R2

Smallholders' Demand for and Access to Private Sector Extension Services: A Case Study of Contracted Cotton Producers in Northern Tanzania

We thank the editor once again for offering us the possibility to improve our paper and we thank the referee for their further comments. Please find below a copy of the further comments/questions raised by the editor and referee, together with our reply to each of these comments/questions. We believe we have now covered all queries satisfactorily and have addressed the remaining concerns. If not, we would be once again grateful for a further opportunity to improve the manuscript.

Reply to comments from the editor

Comment 1: The reviewer refers to the niggling issue of clarity on the sampling framework. We understand it is not statistically representative but that was assumed and not the main issue. The question is that even if not statistically representative, if purposive for example, more details and explanation is needed for readers to understand the nature of the sample and how it compares to alternative or representative samples, what sampling criteria were used and what flexibility was allowed into the sampling process. This is for the sake of methodological rigour and also because the story on stratification becomes clearer and more robust if there is a clearer idea of how this sample compares to a representative sample or if this sample misses out on certain categories or not.

Reply 1: We agree with the editor that further clarity was required regarding the sampling for the survey. We have explained the further changes we have made to the manuscript in the response to the reviewer below. All changes have been made in tracked changes.

Reply to comments from Referee #1

Comment 1: The author has addressed most of outstanding issues from the previous version of the paper. However, one niggling issue surrounding the sampling framework remains to be clarified. While the paper now states that the sample is not representative it makes little effort to state how the sample chosen here might differ from a representative sample i.e. why is it not representative? The fact that all respondents were members of the FBG would seem to be very relevant here as it is not clear that poorer producers are as likely to join a FBG as wealthier farmers. The choice of stratification then also becomes relevant - what is the purpose of stratifying a non-representative sample? This would only make sense if we have some better idea of who the sample is not covering or likely to miss out. Then, with these

caveats in mind, the stratification story can be told. To deal with this some additional text is needed to discuss the sample in relation to the wider population of cotton producers in Tanzania.

Reply 1: We thank the reviewer for this excellent comment. We have now inserted the following passage on page 11 of the manuscript:

> *Moreover, the extent to which these findings could be extrapolated to a representative sample is limited. It is well known that contract farming arrangements engage with the upper strata of rural communities and exclude the poorest households (for example, see Singh and Prowse, 2013). As all survey participants in this survey were engaged in contract farming with S&C Ginning, it is highly likely the survey did not reach poor and marginalised groups.*

We have moved the following sentence further down this paragraph to improve the flow of the text:

> *Dates and central locations for interviews were decided in collaboration with the chairman and secretary of the FBG to ensure that members would be available to participate and to minimise costs.*

In addition, we have sought to clarify that the 520 households interviewed during the survey were all contracted cotton producers through inserting the terms 'contracted households' or 'contracted smallholders' throughout the text. These changes have been left as 'tracked changes'.